

REMARKS

1. Claims 1-19 have been rejected under 35 U.S.C. 112, first paragraph. It is unclear to the Applicants what is the basis for the rejection under 35 U.S.C. 112, first paragraph. From the reading of the second full paragraph on page 2 of the Office Action dated June 21, 2006, it appears the Examiner finds the epoxidation process of Claim 1 enabled. However, in the first full paragraph on page 3 of the same Office Action, the Examiner asserts the specification does not enable one skilled in the art to make the invention commensurate in scope with the claims. Claims 1-19 relate to a process for the epoxidation of an olefin, a process for the production of a 1,2-diol, a 1,2-diol ether or an alkanolamine, and a catalyst.

The Examiner emphasizes the unpredictability of the performance of catalysts and states: "The breadth of the claims includes all of the thousands of compounds of formula A as well as the metals copper, silver, gold, zinc, cadmium, and mercury catalysts with presently unknown list of ligands embraced by claim 1." *Office Action*, dated June 21, 2006, sentence bridging pages 4 and 5. The claims of the present application do not contain language directed to a formula A, metals such as copper, gold, zinc, cadmium and mercury, or other possible ligands. The Examiner's rationale for undue experimentation is based upon limitations not included in the claims of the present invention; thus, the Applicants respectfully request the rejection under 35 U.S.C. 112, first paragraph, be withdrawn.

2. Claims 1-30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lauritzen et al US 4,808,738 (hereinafter the '738 publication) in view of Shell WO 95/17957 (hereinafter the '957 publication), Evans et al US 5,418,202 (hereinafter the '202 publication), and Lauritzen et al EP 00352850 (hereinafter '850 publication). This rejection is respectfully traversed. The MPEP § 2143 states:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

The present invention relates to epoxidation catalysts containing a relatively small quantity of a rhenium component, as defined in the claims. It has been found that the catalysts of the present invention retain their selectivity better, such that after a certain period of use they outperform the catalysts which comprise more rhenium and accordingly have a longer service life. *Application Text*, page 4, lines 11-27.

The Examiner states: “[T]he present definition in the claim, that ‘the reaction temperature is increased to at least partly reduce the effect of loss of activity of the catalyst’, is a functional definition, which does not appear to support the applicant’s interpretation, that the disclosed temperature increase in the prior art would not be suitable to meet the said function, namely to reduce an effect of loss of activity of the catalyst.” *Office Action*, dated June 21, 2006, paragraph bridging pages 6 and 7.

Applicants respectfully submit the Examiner errs in his assertion. The claim language, “the reaction temperature is increased to at least partly reduce the effect of loss of activity of the catalyst,” of claim 1 is being treated by the Examiner as a purely functional definition. However, this language contains structural features. This language asserts that, first, there is a loss of activity of the catalyst, and subsequently, the reaction temperature is increased to at least partly reduce the loss of activity of the catalyst.

In the ‘738 publication, the working examples disclose an increase in temperature during the start-up of the reactor. *U.S. Patent No. 4,808,738*, column 20, lines 56-62. These temperature increases occurring during the start-up procedure cannot be construed as occurring after a loss of activity of the catalyst. No further temperature increases are disclosed in the working examples. Additionally, the process to measure initial performance of the catalysts utilized a reactor feed containing vinyl chloride in a quantity of 4.4 to 5.6 parts per million by volume (hereinafter “ppmv”). *Id.* at column 20, lines 51-66.

The ‘957 and ‘202 publications, in describing the state of the art, disclose gradually increasing the reactor temperature as the catalyst activity declines. *PCT International Application Publication No. WO95/17957*, page 1, lines 23-25; *U.S. Patent*

No. 5,418,202, column 1, lines 35-41. In the working examples of the '957 and '202 publications, the reactor feed contained 0.5 to 5 ppmv ethyl chloride during the testing of the catalysts. *PCT International Application Publication No. WO95/17957*, page 19, lines 28-31; *U.S. Patent No. 5,418,202*, column 18, lines 43-47. The '957 and '202 publications disclose an increase in temperature during the start-up of the reactor in the working examples. Illustrative embodiment 2 also discloses an increased temperature value after 215 days of operation of the reactor.

The '850 publication, in describing the state of the art, discloses maintaining constant the chlorohydrocarbon moderator levels in the reactor feed over the period of operation of a non-rhenium containing "conventional" catalyst. *European Patent Specification 352850 B1*, page 2, lines 6-27. The '850 publication teaches that catalysts containing silver and rhenium have longer catalyst lives when the chlorohydrocarbon moderator level is increased over the period of operation of the catalyst. *Id.* at page 2, lines 30-48. The working examples of the '850 publication demonstrate the improvement in catalyst life which is obtained when the chlorohydrocarbon moderator is increased over the period of operation of the rhenium-containing catalyst.

None of the '738, '957, '202 or '850 publications teach or suggest a process for the epoxidation of an olefin utilizing a catalyst comprising rhenium in a quantity of at most 1.5 mmole/kg, relative to the weight of the catalyst, and at most 0.0015 mmole/m², relative to the surface area of the carrier, in which process the reaction temperature is increased to at least partly reduce the effect of loss of activity of the catalyst while the organic halide is present in a relative quantity Q which relative quantity Q is maintained constant. The '738, '957 and '202 publications are silent with respect to increasing the reaction temperature to reduce the effect of loss of activity while the organic halide is present in a relative quantity Q, which is maintained constant. In illustrative embodiment 2 of the both the '957 and '202 publications, an increased reaction temperature value after 215 days of operation is disclosed; however, there is no disclosure regarding the specific amount of ethyl chloride present in the reactor feed. The only disclosure in the working examples regarding the amount of ethyl chloride present in any of the reactor feeds is a wide range of from 0.5 to 5 ppmv. Moreover, the '850 publication teaches away from the present invention by teaching one skilled in the art to increase the

concentration of the chlorohydrocarbon in the feed during the operation of the catalyst to improve the longevity of a rhenium-containing catalyst. Increasing the concentration of the chlorohydrocarbon in the feed leads to a higher relative quantity Q when the other components in the feed are kept constant.

Therefore, there is no suggestion or motivation to modify or combine the '738, '957, '202, and '850 publications to arrive at the process of the present invention.

Additionally, one of ordinary skill in the art would not have had a reasonable expectation of success in combining the '738, '957, '202, and '850 publications to arrive at the process of the present invention. As discussed hereinbefore, the '738, '957 and '202 publications do not teach or suggest increasing the reaction temperature to reduce the effect of loss of activity while the organic halide is present in a relative quantity Q which relative quantity Q is maintained constant, and the '850 publication teaches increasing the concentration of chlorohydrocarbon moderator in the feed over the period of operation of a rhenium-containing catalyst. The suggestion or expressed expectation of success when combining the publications would be to improve the longevity of a rhenium-containing catalyst by increasing the concentration of chlorohydrocarbon moderator in the reactor feed over the period of operation. As discussed above, increasing the concentration of chlorohydrocarbon in the feed leads to a higher relative quantity Q when the other components in the feed are kept constant.

Therefore, there is no reasonable expectation of success in arriving at the process of the present invention when modifying or combining the '738, '957, '202 and '850 publications.

Further, the '738, '957, '202 and '850 publications do not teach or suggest all the claim limitations. The references do not teach or suggest all the features of a process for the epoxidation of an olefin, which process comprises reacting a feed comprising an olefin, oxygen and an organic halide, in the presence of a catalyst comprising silver and rhenium deposited on a carrier, wherein the catalyst comprises rhenium in a quantity of at most 1.5 mmole/kg, relative to the weight of the catalyst, and at most 0.0015 mmole/m², relative to the surface area of the carrier, and in which process the reaction temperature is increased to at least partly reduce the effect of loss of activity of the catalyst while the organic halide is present in a relative quantity Q which is maintained constant, which

relative quantity Q is the ratio of an effective molar quantity of active halogen species present in the feed to an effective molar quantity of hydrocarbons present in the feed.

In view of these arguments, the three criteria for establishing a *prima facie* basis for obviousness have not been met for the process claims.

The '738 publication teaches an epoxidation catalyst containing silver, alkali metal, rhenium and a rhenium copromoter selected from sulfur, molybdenum, tungsten, chromium, and mixtures thereof. *U.S. Patent No. 4,808,738*, column 2, lines 1-11. The amounts of rhenium and rhenium copromoter present on the catalyst are generically disclosed as ranging from about 0.1 to 10, more preferably from about 0.2 to 5 mmoles per kilogram of total catalyst. *Id.* at column 8, lines 57-62; column 11, lines 36-40. The surface areas generically disclosed for the support are below about 10 m²/g and preferably below about 3 m²/g. *Id.* at column 3, line 40 – column 4, line 4. In the working examples of the '738 publication, the catalysts contain an amount of rhenium promoter in the range of from 0.5 to 4 µmoles/gram of catalyst, an amount of rhenium copromoter in the range of from 0.5 to 3 µmoles/gram of catalyst, and the surface areas of the carriers used to prepare the catalysts range from 0.21 to 2.06 m²/g. Experiment No. 4-2 discloses a silver-based catalyst containing 0.5 mmole of rhenium and 0.5 mmole of sulfur per kilogram of catalyst deposited on a support having a surface area of 0.21 m²/g. Experiment No. 5-2 discloses a silver-based catalyst containing 0.5 mmole of rhenium per kilogram of catalyst deposited on a support having a surface area of 0.42 m²/g. The catalyst of Experiment No. 5-2 does not contain a rhenium copromoter.

The '957 and '202 publications have similar generic disclosures as the '738 publication with respect to surface areas of the support, amount of rhenium promoter present on the catalyst, and the presence of a rhenium copromoter on the catalyst. *PCT International Application Publication No. WO95/17957*, page 3, lines 32-35; page 7, lines 19-21; page 8, lines 4-7; *U.S. Patent No. 5,418,202*, column 3, lines 22-26; column 6, lines 60-62; column 7, lines 16-20. In the working examples of both the '957 and '202 publications, the catalysts contain an amount of rhenium promoter in the range of from 1.2 to 1.5 mmoles per kilogram of catalyst and the surface areas of the carriers used to prepare the catalysts are in the range of from 0.48 to 1.01 m²/g. In illustrative embodiment 3, Table VI describes the composition utilized to form the carrier used in the

preparation of catalysts A-6 and SA-6. The physical properties for the individual alpha alumina powders used to form the finished carrier are disclosed in the footnotes to Table VI. The physical properties include the surfaces areas of the individual alpha alumina powders. However, after firing the composition of Table VI at 1450 °C, the finished carrier has a surface area of 1.01 m²/g, as disclosed in Table VII. It is this finished carrier upon which the silver, 1.5 mmoles rhenium and 1.5 mmoles rhenium copromoter are deposited to form catalysts A-6 and SA-6.

The '850 publication also contains similar generic disclosures as the '738 publication with respect to the amounts of rhenium and rhenium copromoter. *European Patent Specification 352850 B1*, page 4, lines 19-23. In the working examples of the '850 publication, there is no disclosure of the quantities of rhenium promoter, rhenium copromoter or surface area of the carrier used in preparing the catalysts tested.

None of the '738, '957, '202, or '850 publications teach or suggest a catalyst having improved catalyst life comprising silver, rhenium in a quantity of at most 0.9 mmole/kg, relative to the weight of the catalyst, and at most 0.0015 mmole/m², relative to the surface area of the carrier, and a rhenium copromoter selected from tungsten, molybdenum, chromium, sulfur, phosphorus, boron, and compounds thereof in a quantity of at least 0.1 mmole/kg, based on the total of the elements, relative to the weight of the catalyst. The '738, '957, '202, and '850 publications all disclose similar generic ranges of rhenium promoter to be deposited on the support; however, the publications do not teach or suggest the amount of rhenium that should be present on the catalyst relative to the surface area of the carrier. Further, in the working examples of the '738 publication, Table 5 teaches away from using catalysts with at most 0.9 mmole of rhenium per kilogram of catalyst. Experiments 5-1 through 5-7 teach the best performance of a catalyst occurs when using a catalyst containing rhenium in a quantity of 2 to 3 mmoles per kilogram of catalyst.

Therefore, there is no suggestion or motivation to modify or combine the '738, '957, '202, and '850 publications to arrive at the catalyst of the present invention.

Additionally, there is no reasonable expectation of success in arriving at the catalyst of the present invention when modifying or combining the '738, '957, '202, and '850 publications. Bits and pieces of the invention can be pointed to in the publications,

but only if one is armed with hindsight knowledge. The '738, '957, '202, and '850 publications do not teach or suggest any relationship between the amount of rhenium and the surface area of the support, and the '738 publication teaches away from using catalysts with at most 0.9 mmole of rhenium per kilogram of catalyst, as discussed above.

Also, the '738, '957, '202, and '850 publications do not teach or suggest all the features of a catalyst comprising silver, rhenium and a rhenium copromoter selected from tungsten, molybdenum, chromium, sulfur, phosphorus, boron, and compounds thereof deposited on a carrier, wherein the catalyst comprises rhenium in a quantity of at most 0.9 mmole/kg, relative to the weight of the catalyst, and at most 0.0015 mmole/m², relative to the surface area of the carrier, and wherein the catalyst further comprises the rhenium copromoter in a quantity of at least 0.1 mmole/kg, based on the total of the elements, relative to the weight of the catalyst.

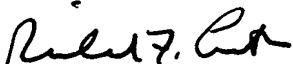
In view of these arguments, the three criteria for establishing a *prima facie* basis for obviousness have not been met. Applicants respectfully request that the rejection be withdrawn.

CONCLUSION

The rejections having been traversed, allowance of the claims of the present application is respectfully requested. If the Examiner would like to discuss this case with Applicants' attorney, the Examiner is invited to contact Richard Lemuth at the phone number below.

Respectfully submitted,
MAREK MATUSZ ET AL

By _____



Their Attorney, Richard F. Lemuth
Registration No. 30,081
(713) 241-3716

P. O. Box 2463
Houston, Texas 77252-2463